NOTE

Subject: EPA Comments on "Draft Coal Combustion Residue Impoundment: Round 12 – Dam Assessment Report – City of Ames Power Plant"

To: File

Date: October 25, 2012

1. It may be advantageous to clarify the names of the units early in the draft report, as "Fly Ash Pond," "Lime Cell," and "Lime and Ash Pond" are used interchangeably. The names of the units are not clarified until Section 2.1.
2. On page 2-1, section 2.1 "Location and General Description," it may be advantageous to include the description of the presence or lack of hydraulic connection between the two cells in the dual-use diked impoundment. It is not evident from the text that there is a hydraulic connection, e.g., culvert, decant structure, between the two units through the engineered divider dike.
3. On page 2-6, first line (section 2.5.1), replace "USACOE" with "USACE."
4. On page 2-6, section 2.5.2 "Outlet Structures," it may be advantageous to detail the "Clear Water Pond." From the report, it appears that the "Clear Water Pond" is located downstream of the Fly Ash Pond but located within the diked impoundment (See Section 5.3.2). If this is true, it may be advantageous to clarify in the original description of the impoundment (Section 2.1 – "The impoundment is divided into two approximately equal cells…"). Additionally, it would be advantageous to define the Clear Water Pond in Figure 2.1b, as the figure currently only identifies the Lime Pond and Fly Ash Pond. If the Clear Water Pond is outside of the embankment for the Lime Pond/Fly Ash Pond, an explanation as to why it was outside the scope of the assessment will be necessary as it is hydraulically connected downstream to the Fly Ash Pond and may receive CCRs.
5. On page 4-1, Section 4.1.1 "Original Construction," it may be advantageous to address the construction history and material of the separator dike if known, as the divider dike is integral to the overall structural integrity of the CCR management unit. If no known construction information is known, e.g., construction material, it should be stated as such.
6. On page 5-1, section 5.2 is titled "BOTTOM ASH DISPOSAL AREA 2." Please retitle appropriately to the unit that is being assessed at AMES.
7. In Section 6.3 "Assessment of Hydrologic/Hydraulic Safety," it may be advantageous to explain that the freeboard is expected to be adequate based on Dewberry's simple hydrologic calculations given the design storm.
8. On page 7-1, section 7.1.2, the report identifies 25 borings drilled in 1980. Please indicate, whether or not the footprint has changed, and if it has not changed, whether or not these borings could be used for stability analyses.
9. On page 7-2, section 7.1.5, the contractor notes the susceptibility of liquefaction due to "the limited data available, the loose silty fine sands at the subgrade elevation of the impoundment…" This potential risk should be included in sections 7.3 and 1.1.1. In addition, it may be advantageous to include a recommendation for liquefaction potential analyses in section 1.2.2.

CITY OF
Ames
Smart Choice

January 3, 2014

Ms. Jana Englander
Office of Resource Conservation and Recovery
U.S. Environmental Protection Agency
Ariel Rios Building
1200 Pennsylvania Avenue, N.W.
Mail Code 5304P
Washington, DC 20460

Re: Comments and Corrections Pertaining to Draft EPA Report -
"Coal Combustion Residue Impoundment - Round 12 - Dam Assessment Report" for the City of Ames Power Plant

Dear Ms. Englander:

This letter contains the City of Ames' (Iowa) comments in response to the draft "Coal Combustion Residue Impoundment - Round 12 - Dam Assessment Report" issued by U.S. Environmental Protection Agency (EPA) on September 30, 2013. To date, the correspondence history between the EPA and he City of Ames (City or COA) regarding this draft report has been:

-Issuance of draft report by EPA	09/30/2013
-COA request for 30 day extension to make comments	10/12/2013
-EPA response approving 30-day extension	10/12/2013
-COA status update and request for extension thru 6/30/2014	11/25/2013
-EPA response denying the extension through 6/30/2014	11/25/2013
-COA request for extension to make comments thru 1/3/2014	12/09/2013
-EPA response approving extension through 1/3/2014	12/10/2013

Our response to the draft report will be in two parts: 1) a complete copy of the draft report marked up to show edits and corrections, and 2) this letter which contains our comments referenced to specific locations in the report. (The edited/corrected copy of the draft report is enclosed with this letter.)

Our comments pertaining to the draft report are as follows:

Page ii, at paragraph 3

"In summary, the Ames City Power Plant Ash Pond and Lime Cell management unit is ***POOR***

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for continued safe and reliable operation."

The City strongly disagrees with the characterization that the "management unit is POOR for continued safe and reliable operation." The draft report reaches this conclusion primarily based upon information that the consultant (Dewberry) sought and was not available at the time the draft report was written. We believe that the classification of the management unit should have been primarily based on actual observations of the physical site and the associated operations of the facility.

Page ii, at paragraph 4

Sentence three of this paragraph states: "The initiative will address management units that are classified as having a Less-than-Low, Low, Significant, or High Hazard Potential ranking (for Classification, see pp. 3-8 of the 2004 Federal Guidelines for Dam Safety)."

There is no "Less-than-Low" classification category in the referenced document.

Page 1-1, at 1.1.1

"The dike embankments appear to be structurally sound based on Dewberry engineers' observations during the site visit." Later in the same section they state "...the embankments are rated POOR for structural soundness."

These two statements obviously contradict each other. Once again, Dewberry forms the later conclusion based on the lack of a slope stability analysis for the project. (The City has solicited proposals for a seismic and static slope stability study to be performed, and the selection of the firm to perform the study is forthcoming. Upon completion of the study and the subsequent report, the results will be forwarded to EPA so that the preliminary conclusions of this draft report can be appropriately amended.)

Page 1-1, at 1.1.2

Dewberry states that: "Documentation of the hydrologic and hydraulic safety was not provided to Dewberry for review." They go on to conclude that "Based on the lack of documentation of hydrologic and hydraulic analyses, the management unit is rated POOR for hydrologic and hydraulic safety."

Documentation regarding hydrologic and hydraulic safety was indeed provided. This information was forwarded to Dewberry on September 11, 2012, in an email in which a table from the United States Geological Survey (USGS) was attached showing where actual

conditions (on the South Skunk River in Ames, Iowa) in 2008 and 2010 equaled or exceeded a 100 year flood event. During each of these two events (in 2008 and 2010), the Lime Pond and the Ash Pond did not have any hydrologic or hydraulic safety incidents.

Page 1-1, at 1.1.3

In this section, the draft report repeats that "The supporting technical documentation is inadequate. No documentation of either hydrologic or hydraulic safety, or slope stability was provided to Dewberry for review."

As already stated, hydrologic and hydraulic safety information was provided, and slope stability analysis information will be provided upon completion.

Page 1-2, at 1.1.6

"The presence of trees on the exterior and interior slopes of the embankment, and erosion along sections of the interior embankments of the Fly Ash Pond indicate the maintenance program needs enhancement."

The City's Water & Pollution Control Department and the Power Plant have developed a joint action plan for the removal of trees and repair of the exterior embankment slope. The Power Plant has the responsibility for tree removal and erosion repair of the interior embankment slopes (along the interior of the Ash Pond). This work is planned to commence this spring (2014).

Page 1-2, at 1.1.7

In this section, the second sentence states: "The surveillance program appears to lack a component regarding observation of the embankments for signs of distress, or potential to the safety of the slope, including trees on the slope, potential seepage issues, animal burrows, etc."

The Power Plant started a weekly documented visual inspection of the Ash Pond embankments the week of October 13, 2013, for the situations and conditions listed above.

Page 1-2, at 1.1.8

"The Fly Ash Pond and Lime Pond impoundment embankments are rated POOR for continued safe and reliable operation."

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We strongly believe that based upon actual physical conditions of the impoundment embankments, they should not be classified as "POOR for continued safe and reliable operation." This rating, like similar other ratings in the report, seem to be based upon information and data that the EPA's contractor (Dewberry) desired and did not have available (or was overlooked as in the case of flood data) at the time the draft report was written. The unavailability of certain information that Dewberry desired, in and of itself does not make the facility unsafe or unreliable.

Page 1-2, at 1.2.1

In this section, the report again asks that the utility provide a slope stability study for static and seismic loading conditions.

As stated previously, the City has solicited proposals for a seismic and static slope stability study to be performed, and the selection of the firm to perform the study is forthcoming. Upon completion of the study and the subsequent report, the results will be forwarded to EPA, so that the preliminary conclusions of the draft report can be appropriately amended.

Page 1-3, at 1.2.2

Bullet 1: Request for hydrologic and hydraulic data...
Bullet 2: Request for slope stability factors of safety...
Bullet 3: Request for documentation of construction quality control activities...

Pertaining to bullet 1 and as previously stated, documentation regarding hydrologic and hydraulic safety was provided. This information was forwarded to Dewberry on September 11, 2012, in an email in which a table from the USGS was attached showing where actual conditions (on the South Skunk River in Ames, Iowa) in 2008 and 2010 equaled or exceeded a 100 year flood event. During each of these two events (in 2008 and 2010), the Lime Pond and the Ash Pond did not encounter any hydrologic or hydraulic safety incidents.

Pertaining to bullet 2, the City has solicited proposals for a seismic and static slope stability study to be performed, and the selection of the firm to perform the study is forthcoming. Upon completion of the study and the subsequent report, the results will be forwarded to EPA so that the preliminary conclusions of the draft report can be appropriately amended.

Regarding bullet 3, the City has contacted and engaged the original architect/engineer of the project for a search their archives for construction field notes and other construction related documents. Available and pertinent documents will be forwarded to the EPA

under separate cover.

Page 1-3, at 1.2.3

This section contains two (2) bulleted recommendations. The first recommendation was to add a weekly documented inspection of the pond embankments. The second recommendation was to increase maintenance of the embankments including removal of trees, and repair of the eroded interior slope of the Ash Pond embankment.

Both recommendations are being addressed. The first recommendation, the weekly inspection, commenced the week of October 13, 2013, and is ongoing. The second recommendation, the removal of trees on the embankments and the repair of erosion on the interior slope of the Ash Pond embankment, is planned and will commence this spring.

Page 2-4, at paragraph 1

"Based on the size of the Lime and Ash Pond embankment height and impoundment storage capacity, the impoundment would be classified as Small by US Army Corps of Engineers (USACE) criteria."

The table referenced in this section of the draft report by Dewberry is from the USACE Engineer Regulations (ER 1110-2-106) shown as Table 1. For a impoundment to fit in the "small" classification of this table, its storage capacity must be in the range of 50 to less than 1000 acre-feet, or the height of the dam must be in the range of 25 to less than 40 feet. Our two impoundments, the Lime Pond and the Ash Pond, are classified as "small" solely on the basis that their storage capacities qualify, at 154.4 and 129.9 acre-feet, respectively.

The heights of the Lime Pond and the Ash Pond are 16 feet and 15 feet, respectively. These heights are significantly less than the "small" category height range of 25 to less than 40 feet from the table (Table 1). The laws of physics are such that the height of the dam influences the risk classification of an impoundment much more so than the storage capacity. Therefore, the size of the City's lime and ash impoundments, which are classified as "small" according to the table (based on storage capacity only), should pose very low risk.

Page 2-4, at paragraph 2 sentence 4

"Based on the presence of an active corn field adjacent to the north embankment of the Lime and Ash Pond, and considering the low probability of loss of life should the Lime and Ash Pond

embankments fail, a Federal Hazard Classification of ***Significant*** *is appropriate for these facilities."*

Even though the criteria Dewberry quoted in the draft report from federal guidelines classifies the dam safety hazard as "significant" (emphasis added), this characterization seems excessive given the actual physical characteristics of the impoundments. The federal guidelines referenced by Dewberry are from FEMA and are found in the publication entitled *Federal Guidelines for Dam Safety: Hazard Potential Classification System for Dams.*

In their use of the FEMA's classification table (Table 2.2b on page 2-4 of the draft report), Dewberry failed to identify the first column of the table which was untitled and should have been titled "Hazard Potential Classification." The authors of the FEMA publication felt it important to clarify that the classification be based upon the "potential" consequences of a failure or a mis-operation of a dam, and not on the current status of a dam. This is stated clearly and repeatedly in the FEMA publication, and referenced as follows:

Page 3, 2nd sentence under the definition of HAZARD POTENTIAL CLASSIFICATION:

> **"The hazard potential classification does not reflect in any way on the current condition of the dam (e.g., safety, structural integrity, flood routing capacity)."**

Page A-2, paragraph 5

> **"The Task Group considers it important that the term "Potential" be incorporated in each classification system name. This term helps the public understand the significant difference between hazards that "may" become real and any current actual safety concerns for the dam."**

Page A-3, Item 2.

> **"2.The hazard potential rating does not reflect in any way on the current safety, structural integrity, or flood routing capability of the project water retaining structure."**

Page 6-1, at 6.1.1

"No documentation has been provided about the flood of record."

Statement is inaccurate. Dewberry was sent an email on 9/11/2012 to which was attached a USGS table (entitled "Table 3. Maximum stages and discharges for 2010 and selected largest-flood years, and the corresponding flood-probability ranges, at streamgages in the South Skink River Basin, Iowa")

Page 6-2, at 6.1.4

"No downstream flood analysis was provided."

Statement is inaccurate. See the preceding comment above, referencing page 6-1, at 6.1.1.

Page 7-1, at 7.1.1

"No slope stability analyses data was provided to Dewberry for review."

As has been stated previously, the City has solicited proposals for a seismic and static slope stability study to be performed, and the selection of the firm to perform the study is forthcoming. Upon completion of the study and the subsequent report, the results will be forwarded to EPA so that the preliminary conclusions of the draft report can be appropriately amended.

Page 7-1, at 7.1.2

"No design parameters assigned to the dam materials was provided to Dewberry for review."

This statement is not accurate. On the day of the site inspection, August 20, 2012, Dewberry was given the following Lutz, Daily & Brain (LD&B) drawings and specifications pertaining to the construction of the Lime Pond and Ash Pond systems.

LD&B Drawing 76-11-ASH-11	**Lime and Ash Pond Plan**
LD&B Drawing 76-11-ASH-12	**Lime Pond Dike Cross Sections**
LD&B Drawing 76-11-ASH-13	**Ash Pond Dike Cross Sections**
LD&B Drawing 76-11-ASH-14	**Ash Disposal Area Test Borings**
LD&B Drawing 76-11-ASH-15	**Outlet Structures and Details**

LD&B Specifications	
Clearing and Grubbing	**D-16 – D-17**
Excavation and Backfill	**D-18 – D-25**

Embankment	**D-26 – D-30**
Crushed Rock Road Surfacing and Base Course	**D-31 – D-32**
Stone Riprap	**D-33 – D-34**
Class B Bedding	**D-35**
Class A Bedding	**D-36**
Seeding	**D-85 – D-88**
Soil Sterilization (Vegetation Control)	**D-89**

Page 7-1, at 7.1.3

"No documentation of uplift force or phreatic surface assumptions was provided to Dewberry for review."

During the inspection on August 20, 2012, and later by email (on August 28, 2012), we were asked by Dewberry to provide:

- **any construction quality control/ quality assurance field reports pertaining to the placement of materials to construct the embankments,**
- **slope stability analyses to determine the factors of safety under seismic and static loading conditions, and**
- **hydrologic and hydraulic safety of the impoundments under a design storm event.**

We were not asked by Dewberry to provide any uplift force or phreatic surface assumptions.

We did provide Dewberry with 16 soil boring logs of the main power plant footprint taken in the 1978-79 timeframe, and logs of 25 soil borings and 3 piezometers taken in the areas of the Lime Pond and the Ash Pond during 1980. These logs do show the water table level as found for each boring.

Page 7-2, at 7.1.4

"Documentation of slope stability analyses or base stresses was not provided to Dewberry for review."

As has been stated previously, the City has solicited proposals for a seismic and static slope stability study to be performed, and the selection of the firm to perform the study is forthcoming. Upon completion of the study and the subsequent report, the results will be forwarded to EPA so that the preliminary conclusions of the draft report can be

appropriately amended.

Page7-2, at 7.1.5

"Documentation of liquefaction potential of soils at the site was not provided for review. Based on the limited data available, the loose silty fine sands at the subgrade elevation of the impoundment are expected to be susceptible to liquefaction resulting from a seismic event. However, the project specifications provided to Dewberry for review required the embankment subgrade to be compacted to a minimum density of 90 percent of maximum dry density for impermeable soils, or 80 percent relative density for pervious soils."

We were not asked specifically for documentation pertaining to the liquefaction potential of the soils at the site, however, the slope stability study information which we were asked for and will provide upon completion, should provide the soils liquefaction information that the report asks for.

The second and third sentences quoted above contradict each other. Sentence two states that some of the soils used are expected to be at risk for liquefaction, while sentence three implies that the compaction required by the project specification mitigates that risk (emphasis added).

Page 7-2, at 7.2

"Structural stability documentation is inadequate to support a quantitative analysis of the stability of the embankments impounding the Lime and Ash Pond."

As has been stated previously, the City has solicited proposals for a seismic and static slope stability study to be performed, and the selection of the firm to perform the study is forthcoming. Upon completion of the study and the subsequent report, the results will be forwarded to EPA so that the preliminary conclusions of the draft report can be appropriately amended.

Page 7-2, at 7.3

"Based on the lack of technical documentation, the structural stability of the Lime and Ash Pond is rated as POOR."

Given the low heads (<25 feet) of each impoundment (the Lime Pond and the Ash Pond), the fact that the embankments are in good shape, and that the impoundments successfully withstood a 100 year rain/flood event (1-2% annual flood probability) in 2008 and a 500

year rain/flood event (<0.2% annual flood probability) in 2010 without incident (such as overtopping), the City believes that the structural stability rating of POOR is not justified.

Page 8-2, at 8.3.2

Bullet 1: Recommend repair of eroded interior embankment sections...
Bullet 2: Recommend removal of trees from interior and exterior embankment slopes...
Bullet 3: Recommend weekly embankment inspection program...

Regarding bullet 1, the repair of the interior portions of the Ash Pond is planned to commence this spring (2014).

Regarding bullet 2, the City's Water & Pollution Control Department and the Power Plant have developed a joint action plan for the removal of trees and repair of the exterior embankment slopes.

And finally, an embankment inspection program for the Ash Pond system has been initiated by the Power Plant starting the week of October 13, 2013.

Page 9-1, at 9.3.1

"Based on the data reviewed by Dewberry, including observations during the site visit, the inspection program is inadequate."

As has been stated previously, an embankment inspection program has been initiated by the Power Plant commencing the week of October 13, 2013.

Page 9-1, at 9.3.2

"Based on the data reviewed by Dewberry, including observations during the site visit, the monitoring program is inadequate.

Dewberry recommends that the existing monitoring program be enhanced to include a weekly inspection of the embankments for signs of distress and to identify maintenance needs.

The small size of the impoundment does not warrant a sophisticated monitoring system. However, Dewberry recommends that the three existing piezometers be located and inspected to determine if they remain functional. If yes, the piezometers should be read monthly as part of an enhanced monitoring program."

The second paragraph above should be relocated and inserted as the second paragraph in section 9.3.1 of the report.

The three (3) piezometers have been located and visually inspected and appear to be in good condition. This spring we will inspect the piezometers internally and develop a program to read them monthly as recommended.

We thank you for your patience and the extensions of time you granted in which to file our comments and edits regarding the draft report. If you have any questions about the comments in this letter or about the edits and corrections made to the draft report, please feel free to contact me by telephone at 515-239-5176 or via email at btrower@city.ames.ia.us.

Sincerely,

Brian Trower
Assistant Director-Electric Services
Ames Municipal Electric System
City of Ames, Iowa

Enclosure

C City of Ames Water and Pollution Control Department

DRAFT

Coal Combustion Residue Impoundment
Round 12 - Dam Assessment Report

City of Ames Power Plant

Lime and Ash Pond
City of Ames
Ames, Iowa

Prepared for:

United States Environmental Protection Agency
Office of Resource Conservation and Recovery

Prepared by:

Dewberry & Davis, LLC
Fairfax, Virginia

Under Contract Number: EP-09W001727
October 2012

DRAFT

INTRODUCTION, SUMMARY CONCLUSIONS AND RECOMMENDATIONS

The release of over five million cubic yards of coal combustion residue from the Tennessee Valley Authority's Kingston, Tennessee facility in December 2008, which flooded more than 300 acres of land and damaged homes and property, is a wake-up call for diligence on coal combustion residue disposal units. A first step toward this goal is to assess the stability and functionality of the ash impoundments and other units, then quickly take any needed corrective measures.

This assessment of the stability and functionality of the City of Ames Power Plant Ash Pond and Lime ~~Cell~~ Pond impoundment dikes is based on a review of available documents and on the site assessment conducted by Dewberry personnel on August 20, 2012. This is an unusual management unit configuration, because the ~~Fly~~ Plant's Ash Pond operated by the City of Ames Power Plant shares an impoundment with the Water ~~Department~~ Plant's Lime ~~Cell~~ Pond. We found the supporting technical documentation incomplete (Section 1.1.3). As detailed in Section 1.2, there are two recommendations that would help to ensure a safe and trouble-free operation.

In summary, the ~~City~~ City of Ames Power Plant Ash Pond and Lime ~~Cell~~ Pond management unit is **POOR** for continued safe and reliable operation.

PURPOSE AND SCOPE

The U.S. Environmental Protection Agency (EPA) is investigating the potential for catastrophic failure of Coal Combustion Surface Impoundments (i.e., management units) from occurring at electric utilities in an effort to protect lives and property from the consequences of a dam failure or the improper release of impounded slurry. The EPA initiative is intended to identify conditions that may adversely affect the structural stability and functionality of a management unit and its appurtenant structures (if present); to note the extent of deterioration (if present) and the status of maintenance and/or a need for immediate repair; to evaluate conformity with current design and construction practices; and to determine the hazard potential classification for units not currently classified by the management unit owner or by a state or federal agency. The initiative will address management units that are classified as having a Less-than-Low, Low, Significant, or High Hazard Potential ranking (for Classification, see pp. 3-8 of the 2004 Federal Guidelines for Dam Safety).

In early 2009, the EPA sent letters to coal-fired electric utilities seeking information on the safety of surface impoundments and similar facilities that receive liquid-borne material to store or dispose of coal combustion residue. This letter was issued under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 104(e), to assist the Agency in assessing the structural stability and functionality of such

management units, including which facilities should be visited to perform a safety assessment of the berms, dikes, and dams used in the construction of these impoundments.

EPA requested that utility companies identify all management units including surface impoundments or similar diked or bermed management units or management units designated as landfills that receive liquid-borne material used for the storage or disposal of residuals or by-products from the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. Utility companies provided information on the size, design, age, and the amount of material placed in the units.

The purpose of this report is **to evaluate the condition and potential of residue release from management units and to determine the hazard potential classification**. This evaluation included a site visit. Prior to conducting the site visit, a two-person team reviewed the information submitted to EPA, reviewed any relevant, publicly available information from state or federal agencies regarding the unit hazard potential classification (if any) and accepted information provided via telephone communication with the management unit owner. After the field visit, additional information was received by Dewberry & Davis LLC about the City of Ames Power Plant Lime and Ash Pond that was reviewed and used in preparation of this report.

This report presents the opinion of the assessment team as to the potential of catastrophic failure and reports on the condition of the management unit(s).

Note: The terms "embankment", "berm", "dike" and "dam" are used interchangeably within this report, as are the terms "pond", "basin", and "impoundment".

LIMITATIONS

The assessment of dam safety reported herein is based on field observations and review of readily available information provided by the owner/operator of the subject coal combustion residue management unit(s). Qualified Dewberry engineering personnel performed the field observations and review and made the assessment in conformance with the required scope of work and in accordance with reasonable and acceptable engineering practices. No other warranty, either written or implied, is made with regard to our assessment of dam safety.

DRAFT

Table of Contents

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APPENDIX A

Doc 01:	Lime and Ash Pond Embankment Design Drawings
Doc 02:	Embankment Construction Earthwork Specifications
Doc 03:	NPDES Permit No. TN 85003-0-02
Doc 04:	Design Drawing "Lime and Ash Pond Outlet Structures and Details"
Doc 05:	Iowa Stormwater Management Manual, Section 2C-2, Rainfall and Runoff Analysis
Doc 06:	Soil Boring Logs for Lime and Ash Pond, Borings Drilled March, 1980
Doc 07:	Soil Boring Logs for Lime and Ash Pond, Borings Drilled July, 1980

APPENDIX B

Doc 08:	Dam Inspection Check List Lime and Ash Pond

1.0 CONCLUSIONS AND RECOMMENDATIONS

1.1 CONCLUSIONS

Conclusions are based on visual observations from a one-day site visit on August 20, 2012, and review of technical documentation provided by the City of Ames, IA ~~Electrical Department~~ Electric Utility.

1.1.1 Conclusions Regarding the Structural Soundness of the Management Unit(s)

The dike embankments appear to be structurally sound based on Dewberry engineers' observations during the site visit. Documentation of slope stability Factors of Safety under static and seismic conditions for the Lime Pond and Ash Pond was not provided for review.

Based on the lack of documentation of slope stability factors of safety, the embankments are rated POOR for structural soundness.

1.1.2 Conclusions Regarding the Hydrologic/Hydraulic Safety of the Management Unit

Documentation of the hydrologic and hydraulic safety was not provided to Dewberry for review.

Based on the lack of documentation of hydrologic and hydraulic analyses, the management unit is rated POOR for hydrologic and hydraulic safety.

1.1.3 Conclusions Regarding the Adequacy of Supporting Technical Documentation

The supporting technical documentation is inadequate. No documentation of either hydrologic and hydraulic safety, or slope stability was provided to Dewberry for review.

1.1.4 Conclusions Regarding the Description of the Management Unit(s)

The description of the management unit provided by the owner was an accurate representation of what Dewberry observed in the field.

1.1.5 Conclusions Regarding the Field Observations

Dewberry staff was provided access to all areas in the vicinity of the management unit required to conduct a thorough field observation. The visible parts of the embankments were observed to have no signs of overstress, significant settlement, shear failure, or other signs of

instability. Embankments appear structurally sound. There are no apparent indications of unsafe conditions or conditions needing remedial action.

The ~~Fly~~ Ash Pond does not have an outlet structure (i.e., there is no discharge to the environment). Sluice water and ~~storm water~~ precipitation falling into the ~~Fly~~ Ash Pond are directed to the Clear Water pond before being pumped back to the power plant for reuse.

1.1.6 Conclusions Regarding the Adequacy of Maintenance and Methods of Operation

The presence of trees on the exterior and interior slopes of the embankment, and erosion along sections of the interior embankments of the ~~Fly~~ Ash Pond indicate the maintenance program needs enhancement.

1.1.7 Conclusions Regarding the Adequacy of the Surveillance and Monitoring Program

The Lime and Ash Pond monitoring program consists of daily monitoring of the ~~Fly~~ Ash Pond pool elevation, and the condition of the recirculation pumps. The surveillance program appears to lack a component regarding observation of the embankments for signs of distress, or potential threats to the safety of the slope, including trees on the slope, potential seepage issues, animal burrows, etc.

1.1.8 Classification Regarding Suitability for Continued Safe and Reliable Operation

The ~~Fly~~ Ash Pond and Lime ~~Cell~~ impoundment embankments are rated POOR for continued safe and reliable operation.

1.2 RECOMMENDATIONS

1.2.1 Recommendations Regarding Structural Stability

Recommendations regarding structural stability relates to documentation and operational issues. Specifically, the utility needs to provide the Lime and Ash Pond embankment slope stability Factors of Safety for static and seismic loading conditions. Recommendations pertaining to documenting those elements are presented in the following paragraphs.

1.2.2 Recommendations Regarding the Supporting Technical Documentation

Additional documentation is recommended to:

- Provide hydrologic and hydraulic data to verify the Lime and Ash Pond can contain the one-percent probability in any given year's storm events without overtopping the embankments
- Provide engineering documentation that the Lime and Ash Pond embankment slope stability Factors of Safety for static and seismic loading conditions meet or exceed minimum requirements
- Provide documentation of construction quality control/quality assurance activities to verify that specified compaction of embankment subgrade soils and fill materials were met.

1.2.3 Recommendations Regarding Continued Safe and Reliable Operation

Recommendations for continued safe and reliable operation of the management unit include:

- Add a weekly visual inspection of the embankment for signs of distress or conditions that are adverse to the continued safe operation of the management unit. Inspections can be documented using a checklist form.
- Increase maintenance activities for the embankments, including:
  - Removal of trees on the exterior and interior slopes
  - Repair eroded area along interior slope of ~~Fly~~ Ash Pond

DRAFT

1.3 PARTICIPANTS AND ACKNOWLEDGEMENT

1.3.1 List of Participants

Brian Trower, City of Ames, IA
Curtis Spence, City of Ames, IA
Tim McCollough, City of Ames, IA
Dave Gammon, City of Ames, IA
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Chad Stobbe, Iowa Department of Natural Resources
Bill Gross, Iowa Department of Natural Resources
Joseph P. Klein, III, P.E, Dewberry
Michael McLaren, P.E, Dewberry

1.3.2 Acknowledgement and Signature

We acknowledge that the management unit referenced herein has been assessed on August 20, 2012.

Joseph P. Klein, III, P.E.

Michael McLaren, P.E.

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2.0 DESCRIPTION OF THE COAL COMBUSTION RESIDUE MANAGEMENT UNIT(S)

2.1 LOCATION AND GENERAL DESCRIPTION

The City of Ames Power Plant is located at the intersection of E. 5th Street and Carroll Ave. in Ames, Iowa. The coordinates of the plant site are 42.0259° N and 93.6091° W. The site is about 800 feet west of the South Skunk River. The Lime and Ash Pond ~~is~~ a single, dual-use diked impoundment. The impoundment is about 1,600 ~~feet~~ long by about 650 feet wide. The long axis is oriented in the east-west direction. The impoundment is divided into two approximately equal cells, with the ~~Fly~~ Ash Pond on the eastern end, and the Ames Water ~~Department~~ Lime ~~Cell~~ on the western end. The cells are separated by an engineered divider dike that was part of the original facility construction. Figure 2.1a depicts a vicinity map around the Ames Power Plant and the Lime and Ash Pond. Figure 2.1b depicts an aerial view of the City of Ames Power Plant and the CCR impoundment. Table 2.1 presents size information about the active disposal areas.

Figure 2.1 a: Ames, IA Power Plant Vicinity Map

Figure 2.1 b: City of Ames Power Plant and ~~Fly~~ Ash/Lime ~~Cell~~ Impoundment Location~~s~~

Table 2.1: Summary of Dam Dimensions and Size[1]	
	Lime & Ash Pond
Dam Height (ft)	18
Crest Width (ft)	16
Length/Circumference (ft)	4,550
Side Slopes (upstream) H:V	3:1
Side Slopes (downstream) H:V	2.5:1 to 3:1 varies by location

[1] Dimensions based on design drawings prepared by Lutz, Daily and Brain (See Appendix A – Doc 01)

2.2 COAL COMBUSTION RESIDUE HANDLING

2.2.1 Fly Ash

The Ames Power Plant currently operates two coal fired electrical power generating units, designated Units 7 and 8. Fly ash is collected at the base of each stack by electrostatic precipitators. The Unit 7 precipitator ash is deposited into six hoppers. Unit 8 has two precipitators, each with eight hoppers. The collected ash is stored in hoppers and conveyed pneumatically to a silo. Periodically ash from the silo is loaded into trucks for sale, or off-site disposal.

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Fly ash is also collected from the flue gas duct in each unit and deposited into the three hoppers installed at each unit. A jet pump is used to draw ash from the hoppers and transport the ash water sluice to the Fly Ash Pond.

2.2.2 Bottom Ash

Bottom ash and "clinker," or unburned coal and other debris, is collected in hoppers beneath the boilers. A jet pump and sluice method is used to draw material from the hoppers through a crusher and sluice gate before sluicing the crushed material to the Fly Ash Pond (Photograph 2.2.2-1).

Photograph 2.2.2-1: Ash sluice pipe to Fly Ash Pond Receiving Ditch

2.2.3 Boiler Slag

Boiler slag is collected in the hoppers with the bottom ash.

2.2.4 Flue Gas Desulfurization Sludge

No Scrubbers are used in this plant so there is no flue gas desulfurization (FGD) process or related waste products to be discharged.

2.3 SIZE AND HAZARD CLASSIFICATION

Based on the size of the Lime and Ash Pond embankment height and impoundment storage capacity, the impoundment would be classified as Small by US Army Corps of Engineers (USACE) criteria.

Table 2.2a: USACE ER 1110-2-106 Size Classification

Category	Impoundment	
	Storage (Ac-ft)	Height (ft)
Small	50 and < 1,000	25 and < 40
Intermediate	1,000 and < 50,000	40 and < 100
Large	> 50,000	> 100

Federal guidelines for dam safety hazard classification use two criteria: potential loss of human life and economic, environmental, and lifeline losses. Per the Federal Guidelines for Dam Safety dated April 2004, a Significant Hazard Potential classification applies to those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant Hazard Potential dams are often located in agricultural areas. Based on the presence of an active corn field adjacent to the north embankment of the Lime and Ash Pond, and considering the low probability of loss of life should the Lime and Ash Pond embankments fail, a Federal Hazard Classification of **Significant** is appropriate for these facilities.

Table 2.2b: FEMA Federal Guidelines for Dam Safety Hazard Classification

	Loss of Human Life	Economic or Environmental Damage
Low	None Expected	Low and generally limited to owner site
Significant	None Expected	Yes
High	Probable. One or more expected	Yes (but not necessary for classification)

2.4 AMOUNT AND TYPE OF RESIDUALS CURRENTLY CONTAINED IN THE UNIT(S) AND MAXIMUM CAPACITY

The ~~Fly Ash cell of the Lime and~~ Ash Pond only receives sluiced bottom ash, sluiced fly ash, and direct precipitation. The Lime ~~cell of the Lime and Ash~~ Pond receives only ~~dredged~~ lime recovered from the Ames water treatment plant, and direct precipitation. slurry

Table 2.3: Maximum Capacity of Unit

	Ash Pond ~~Cell~~	Lime Pond ~~Cell~~
Surface Area (acre)	12.7	12.8
Current Storage Capacity (cubic yards)	69,059	62,354
Current Storage Capacity (acre-feet)	42.8	38.6
Total Storage Capacity (cubic yards)[1]	209,532	249,142
Total Storage Capacity (acre-feet)	129.9	154.4
Crest Elevation (feet)	+74 ft, including divider dike	+71 ft
Normal Pond Level (feet)	+70	N/A

[1] Elevations relative to City of Ames datum

2.5 PRINCIPAL PROJECT STRUCTURES

2.5.1 Earth Embankment

The north, east and west embankments were designed for a random fill core overlain by a three-foot thick impervious layer on the interior slope and crest.

The south embankment was designed to expand an existing levee by raising the crest elevation three feet, and widening the crest to 20 feet using impervious fill. Widening the embankment was accomplished by placing new fill in the area of the new Lime and ~~Fly~~ Ash Pond. Pond

Technical specifications provided to Dewberry for review defined two types of materials (See Appendix A – Doc 02).

- Pervious material: Free draining sand or gravelly sand consisting of sound, durable particles with no more than 10 percent passing the U.S. Standard No. 200 sieve
- Impervious Material: Fine grained materials of low permeability consisting of clays, clayey silts, or silts and free of plant growth, roots and humus. Particle size of the impermeable material was to have a minimum of 50 percent passing the U.S. Standard No. 200 sieve, and preferably meet the requirements as a soil type CL or

CH based on the USACOE plasticity chart published in the Vicksburg Experiment Station Technical Memorandum 3-357.

Random fill was specified as consisting of pervious materials, non pervious materials, or any combination thereof.

2.5.2 Outlet Structures

Sluice water in the ~~Fly~~ Ash Pond ~~cell~~ drains to the southeast portion of the cell. A drop inlet riser allows decant water into a "Clear Water Pond" located inside the south perimeter of the ~~Fly~~ Ash Pond. Water is pumped from the Clear Water Pond to the plant for recycling through the ash collection systems.

There are no other outlets from the Lime and Ash Pond.

2.6 CRITICAL INFRASTRUCTURE WITHIN FIVE MILES DOWN GRADIENT

The Ames Power Plant is located on the east side of Ames, Iowa. The area to the west of the Lime and Ash Pond is heavily developed with residential, commercial, industrial, and transportation facilities. Topography in the area slopes to the east toward the South Skunk River, about 900 feet west of the Lime and Ash Pond. Based on the size of the impoundment, and site topographic conditions, a release due to failure or misoperation of the impoundment embankments is not expected to impact critical infrastructure facilities. Area topographic conditions are shown on Figure 2.6-1.

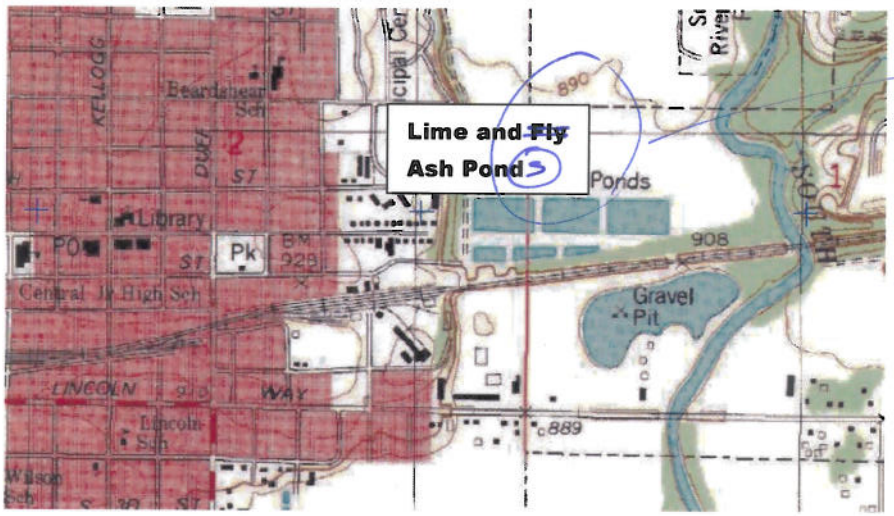

Figure 2.6-1: Lime and Ash Pond Area Topography

3.0 SUMMARY OF RELEVANT REPORTS, PERMITS, AND INCIDENTS

3.1 SUMMARY OF REPORTS ON THE SAFETY OF THE MANAGEMENT UNITS

Ames Electric Services provided a representative report of 2012 daily inspection reports prepared by plant personnel for the ash sluicing system. The inspection report focuses on the ~~Fly~~ Ash Pond pool elevation, and the condition of the recirculation pump intakes. The inspection report does not discuss observations of the embankments.

3.2 SUMMARY OF LOCAL, STATE, AND FEDERAL ENVIRONMENTAL PERMITS

The State of Iowa Department of Natural Resources has issued a National Pollutant Discharge Elimination System Permit. Permit No. ~~85003-0-02~~ was issued July 23, 2001 (See Appendix A – Doc 03). The permit expired July 22, 2006. Ames Electric Services submitted an application for renewal which is still being reviewed by the State.

3.3 SUMMARY OF SPILL/RELEASE INCIDENTS

No recent documented spills or releases have been reported for the Lime and Ash Pond.

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4.0 SUMMARY OF HISTORY OF CONSTRUCTION AND OPERATION

4.1 SUMMARY OF CONSTRUCTION HISTORY

4.1.1 Original Construction

Based on construction drawings provided to Dewberry for review, the Lime and Ash Pond was designed in 1980 and constructed between 1981 and 1982. Dimensions of the Lime and Ash Pond are about 1,600 feet along the east-west axis, and 660 feet along the north-south axis (See Appendix A – Doc. 1).

The north, east and west dikes were constructed of materials excavated from inside the pond footprint, and from the area between the pond and the South Skunk River. The dikes were designed as a random earth fill core with a three-foot thick impervious cover along the interior slope and crest.

The south slope was designed to expand an existing dike that formed an abandoned ash disposal area to the south of the current Lime and Ash Pond. The existing levee was expanded by adding a three-foot thick impervious soil cap to the existing crest, and extending the new slope northward into the footprint of the Lime and Ash Pond. The abandoned ash disposal area is overgrown with vegetation and does not impound water.

An engineered separator dike divides the pond about in half with the Lime Pond on the west side of the divider dike, and the Fly Ash Pond on the east side. The Fly Ash Pond is lined with a three-foot thick layer of compacted impervious material. Other than the interior embankment slopes, the Lime Pond is unlined.

The Ash Pond includes engineered interior dikes inside the south perimeter that form the Clear Water Pond. The Clear Water Pond in divided east and west by an engineered dike. The east end of the Clear Water Pond is the Clear Water Basin and the west end is the Pumping Basin. Decanted water flows from the Fly Ash Pond through the Ash Pond Outlet Structure and Ash Pond Discharge Pipe to the Clear Water Basin. Water flowing through the Ash Pond Outlet Structure runs over a stop log weir, through as 3½ by 4 foot riser, and through the 18-inch Ash Pond Discharge Pipe to the Clear Water Basin. The Ash Pond level is controlled by the stop log weir. (See Appendix A - Doc 04 Clear Water Basin Outlet, Structural Plan and Section 1-ASH-15.)

~~cell that is separated from the Clear Water Pond by an engineered divider dike. Two 24-inch diameter steel pipes carry the water from the Clear~~

Water from the Clear Water Basin flows through the Clear Water Basin Outlet Structure and the Clear Water Basin Discharge Pipe to the Pumping Basin. Water flowing through the Clear Water Basin Outlet Structure flows though a horizontal 1 foot high by 5½ foot wide inlet submerged 6 feet below the Clear Water Basin high water level (70'-0"), into a 3 by 5½ foot riser, over an adjustable height gate weir, into a 2 by 5 foot riser, and through the 12-inch Clear Water Basin Discharge Pipe to the Pumping Basin. The Clear Water Basin level is controlled by the gate weir. (See Appendix A - Doc 4 Clear Water Basin Outlet, Structural Plan and Section 5-ASH-15.)

4.1.2 Significant Changes/Modifications in Design since Original Construction

Based on information provided to Dewberry during the site visit, no significant changes or modifications have been made to the impoundment since the original construction.

4.1.3 Significant Repairs/Rehabilitation since Original Construction

No significant repairs or rehabilitation have been made to the Lime and Ash Pond.

4.2 SUMMARY OF OPERATIONAL PROCEDURES

4.2.1 Original Operational Procedures

The ~~Fly~~ Ash Pond receives sluiced bottom ash and fly ash from the plant. Ash is discharged at the west side of the ~~Fly~~ Ash Pond and allowed to settle out of suspension. An interior ~~ditch~~ directs sluice water to the east end of the ~~Fly~~ Ash Pond. Sluice water flows ~~from the east end of the Fly Ash Pond~~ through an outlet structure into the Clear Water and then into the pump house. From the pump house pond the water is recycled back to the plant.

The Lime Pond receives ~~dried~~ lime from the ~~lime reclamation impoundment adjacent to the south side of the Lime Pond.~~

4.2.2 Significant Changes in Operational Procedures and Original Startup

Based on information provided to Dewberry during the site visit, no significant change ~~on~~ operational procedures have been made since the Lime and Ash Pond ~~was~~ originally put into service.

4.2.3 Current Operational Procedures

Based on observations made during the Dewberry site visit, current operations are substantively the same as described in the original operational procedures.

4.2.4 Other Notable Events since Original Startup

No notable events were reported to Dewberry during the site visit.

5.0 FIELD OBSERVATIONS

5.1 PROJECT OVERVIEW AND SIGNIFICANT FINDINGS

Dewberry personnel Michael McLaren, P.E., and Joseph P. Klein, III, P.E. conducted a site visit on August 20, 2012 in company with the participants.

The site visit began at 8:30 AM. The weather was sunny and warm. Photographs were taken of conditions observed. Please refer to the Dam Inspection Checklist in Appendix B for additional information. Selected photographs are included here for ease of visual reference. All pictures were taken by Dewberry personnel during the site visit. Copies of all photographs were provided to Ames Electric Services.

The overall visual assessment of the dam slopes was that the dikes are in satisfactory condition and no significant findings were noted.

5.2 BOTTOM ASH DISPOSAL AREA 2

5.2.1 Crest

Overall, there were no signs of rutting, depressions, tension cracking, or other indications of settlement or shear failure and the crest appeared to be in satisfactory condition (see Figure 5.2.1-1).

Figure 5.2.1-1 North Dike Crest View East along ~~Fly~~ Ash Pond

5.2.2 Upstream/Inside Slope

No scarps, sloughs, depressions, bulging or other indications of slope instability were observed (see Figure 5.2.2-1). Vegetation along the interior slope generally consisted of various types of grass and weeds. Small trees were observed along the interior slope of the south embankment. Areas of slope erosion were also observed along sections of the south embankment. The erosion was observed to be undermining trees growing on the slope (See Figure 5.2.2-2)

Figure 5.2.2-1 North Dike Interior Slope View West along ~~Fly~~ Ash Pond

Figure 5.2.2-2 Erosion along Inside Slope South Embankment

No scarps, sloughs, depressions, bulging, erosion, or other indications of slope instability were observed along the interior slopes of the Lime Pond (see Figure 5.2.2-3). Vegetation along the interior slope generally consisted of various types of grass and weeds.

Figure5.2.2-3: Lime Pond Interior Slope North Embankment Viewing West

5.2.3 Downstream/Outside Slope and Toe

No scarps, sloughs, depressions, bulging, or other indications of slope instability or signs of erosion were observed. Exterior slopes were vegetated with grass, weeds, and sections of small to medium trees (See Figure 5.2.3-1).

Figure 5.2.3-1: Outside Slope North Embankment Viewing West

No evidence of seepage was observed in the exterior slopes or along the toe of the embankments.

5.2.4 Abutments and Groin Areas

The Lime and Ash Ponds ~~is~~ are part of a fully diked and incised impoundment with no abutments. Groins were found to be in satisfactory condition with no signs of distress (See Figure 5.2.4-1)

Figure 5.2.4-1: Ash Pond Southeast Groin

5.3 OUTLET STRUCTURES

5.3.1 Overflow Structure

The Lime and ~~Fly~~ Ash Ponds ~~does~~ do not have an overflow structure. Sluice water is routed through the ~~Fly~~ Ash Pond to the Clear Water Pond within the impoundment, and pumped back to the plant for recycling. No water from the impoundment is discharged to the environment.

5.3.2 Outlet Conduit

The Ash Pond outlet structure consists of a concrete box riser with an 18-inch diameter outlet pipe discharging into the Clear Water Pond (See Figure 5.3.2-1). The Clear Water Pond is located within the ~~Lime and~~ Ash Pond impoundment. Stop logs in the outlet structure are used to manage the pool elevation in the Ash Pond.

The normal Clear Water outlet consists of ~~two~~ one 24-inch diameter pipes from the Clear Water ~~Pond~~ Basin to the recirculation pumps located at the southwest Pumping Basin and the

corner of the ~~Fly Ash~~ Pond. Flow through the pipes is controlled by a ~~pair of butterfly valves~~ located ~~in~~ a concrete ~~manhole~~ along a dike separating sections of the Clear Water Pond (See Figure 5.3.2-2).

Figure 5.3.2-1 Ash Pond Outlet Structure

Figure 5.3.2-2: Clear Water ~~Pond~~ Outlet ~~Valve~~ Control Structure

5.3.3 Emergency Spillway

The Lime and Ash Pond ~~does~~ not have an emergency spillway.

5.3.4 Low Level Outlet

The Lime and Ash Pond ~~does~~ not have a low level outlet.

6.0 HYDROLOGIC/HYDRAULIC SAFETY

6.1 SUPPORTING TECHNICAL DOCUMENTATION

6.1.1 Flood of Record

No documentation has been provided about the flood of record.

6.1.2 Inflow Design Flood

According to FEMA Federal Guidelines for Dam Safety, the current practice in the design of dams is to use the Inflow Design Flood (IDF) that is deemed appropriate for the hazard potential of the dam and reservoir, and to design spillways and outlet works that are capable of safely accommodating the flood flow without risking the loss of the dam or endangering areas downstream from the dam to flows greater than the inflow. The recommended IDF or spillway design flood for a significant hazard, small-sized structure (See section 2.2) in accordance with the USACE Recommended Guidelines for Safety Inspection of Dams ER 1110-2-106 criteria is the 100 year storm to ½ Probable Maximum Flood (PMF) (See Table 6.1.2).

Table 6.1.2: USACE Hydrologic Evaluation Guidelines Recommended Spillway Design Floods

Hazard	Size	Spillway Design Flood
Low	Small	50- to 100-year frequency
	Intermediate	100-year to ½ PMF
	Large	½ PMF to PMF
Significant	Small	100-year to ½ PMF
	Intermediate	½ PMF to PMF
	Large	PMF
High	Small	½ PMF to PMF
	Intermediate	PMF
	Large	PMF

The Probable Maximum Precipitation (PMP) is defined by the American Meteorological Society as the theoretically greatest depth of precipitation for a given duration that is physically possible over a particular drainage area at a certain time of year. The National Weather Service (NWS)

further states that in consideration of the complicated processes and interrelationships in storms, PMP values are identified as estimates. The NWS has published application procedures that can be used with PMP estimates to develop spatial and temporal characteristics of a Probable Maximum Storm (PMS). A PMS thus developed can be used with a precipitation-runoff simulation model to calculate a PMF hydrograph.

Hydrologic and hydraulic documentation provided to Dewberry for review consisted of the 1980 site plan drawing that shows the South Skunk River "Floodway limit – 0.1 foot rise on 100-year flood" located adjacent to the toe of the east embankment of the impoundment.

A brief internet search by Dewberry found data from the Iowa Stormwater Management Manual, Version 2, December 5, 2008 indicating the one percent probability in any given year (100-year storm) 24 hour precipitation event in central Iowa is 6.61 inches (See Appendix A – Doc 5).

6.1.3 Spillway Rating

The Lime and Ash Pond ~~does~~ not have a spillway discharge. The ~~sole~~ method of discharge from the impoundment is recirculation pumping from the Clear Water Pond cell to the plant.

6.1.4 Downstream Flood Analysis

No downstream flood analysis was provided.

6.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

Supporting documentation reviewed by Dewberry is inadequate.

6.3 ASSESSMENT OF HYDROLOGIC/HYDRAULIC SAFETY

The crest elevation of the Lime and Ash Pond is a minimum of ~~eight~~ feet above the adjacent exterior grade. Stormwater into the impoundment is expected to be limited to direct rainfall.

The normal pool elevation of the ~~Fly~~ Ash Pond is managed to a relatively constant +70 feet, providing a four-foot freeboard. The freeboard ~~is expected~~ to be adequate to contain ~~the~~ one percent probability, 24-hour precipitation event without overtopping the impoundment embankments.

7.0 STRUCTURAL STABILITY

7.1 SUPPORTING TECHNICAL DOCUMENTATION

7.1.1 Stability Analyses and Load Cases Analyzed

No slope stability analyses data was provided to Dewberry for review.

7.1.2 Design Parameters and Dam Materials

No design parameters assigned to the dam materials was provided to Dewberry for review.

Dewberry was provided three sets of boring logs conducted at the Ames Power Plant in conjunction with the design of the Lime and Ash Pond's waste management unit.

- 19 borings located near the power plant drilled June 1978
- 12 borings drilled March 1980 located within the Lime and Ash Pond area (See Appendix A, Doc – 6)
- 13 borings drilled July 1980 (See Appendix A – Doc 7)
    - Nine borings located between the proposed east embankment location and the South Skunk River
    - Four borings, designation borings 13 through 19, located within the Ash Pond section of the Lime and Ash Pond's impoundment.

The location of the 25 borings drilled in 1980 indicate the purpose of the borings was to identify suitable material for excavation and use as compacted fill in the embankments. The borings indicate subsurface conditions consisting of about two to 12 feet of silty to fine sandy clay, or clayey silt, underlain by silty fine to coarse sands. In the borings located within the Lime and Ash Pond impoundment footprint, the design subgrade elevation was in the silty fine to coarse sands range. Only one of the 25 soil borings included standard penetration results. The results indicate the embankment subgrade at the south end of the Lime Pond and Ash Pond divider dike consisted of six feet of very loose to loose, fine sand underlain by loose to medium dense coarse sands.

7.1.3 Uplift and/or Phreatic Surface Assumptions

No documentation of uplift force or phreatic surface assumptions was provided to Dewberry for review.

7.1.4 Factors of Safety and Base Stresses

Documentation of slope stability analyses or base stresses was not provided to Dewberry for review.

7.1.5 Liquefaction Potential

Documentation of liquefaction potential of soils at the site was not provided for review. Based on the limited data available, the loose silty fine sands at the subgrade elevation of the impoundment are expected to be susceptible to liquefaction resulting from a seismic event. However, the project specifications provided to Dewberry for review required the embankment subgrade to be compacted to a minimum density of 90 percent of the maximum dry density for impermeable soils, or 80 percent relative density for pervious soils.

The 2008 USGS seismic risk map indicates the estimated peak ground acceleration for an earthquake having a two percent probability of exceedance in 50 years is 0.06g.

7.1.6 Critical Geological Conditions

Surface geology in the vicinity of the site consists of loose sands and unconsolidated sandy clays deposited by glacial outwash and wind. Some areas are overlain by more recent sediment from stream and riverine flooding.

The boring logs and USGS seismic risk map do not suggest critical geologic conditions representing special hazards to the site.

7.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

Structural stability documentation is inadequate to support a quantitative analysis of the stability of the embankments impounding the Lime and Ash Pond.

7.3 ASSESSMENT OF STRUCTURAL STABILITY

Based on the lack of technical documentation, the structural stability of the Lime and Ash Pond is rated as POOR.

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8.0 ADEQUACY OF MAINTENANCE AND METHODS OF OPERATION

8.1 OPERATING PROCEDURES

Bottom ash ~~and~~ fly ash from the ~~flue gas~~ outlet ~~ducts is~~ collected and sluiced to the ~~Fly~~ Ash Pond ~~section of the Lime and Ash Pond~~. Sluiced ash is discharged at the western end of the ~~Fly~~ Ash Pond where ash is allowed to settle out of suspension. Sluice water flows ~~through a ditch~~ to the east end of the ~~Fly~~ Ash Pond and is held to allow additional settling of suspended solids. Decant water from the settling area flows through a riser structure spillway structure to a Clear Water inside divider dikes within the ~~Fly~~ Ash Pond. Water from the Clear Water is pumped to the plant for recycling in the sluice process.

Water level in the ~~Fly~~ Ash Pond is controlled by stop logs in the riser structure to the Clear Water.

The Lime Pond is used to dewater lime slurry from the City of Ames water treatment plant. Sluiced lime is also discharged into one of three dewatering cells south of and adjacent to the Lime Pond. Water settles out of the lime slurry, infiltrating the aquifer through the cell's sand bottom. Once the lime in a cell dries sufficiently, the dewatered lime is dredged and hauled offsite for beneficial reuse. If required, it may be moved to a covered temporary storage pad for additional drying. When a cell is emptied, it is available to receive more lime slurry. Information provided during the Dewberry site visit indicated that the cells are cycled through on an annual basis.

~~The prior settling cell becomes the drying cell, and the prior drying cell becomes the settling cell. Information provided during the Dewberry site visit indicated that the cells cycle through the functions on an annual basis.~~

8.2 MAINTENANCE OF THE DAM AND PROJECT FACILITIES

Maintenance of the impoundment generally consists of adjustment to the ~~Fly~~ Ash Pond riser structure stop logs to control pool elevation, and maintenance on pumps used to recycle decanted sluice water back to the power plant. It appeared that mowing grass is performed periodically on the west and east embankment exterior slopes.

8.3 ASSESSMENT OF MAINTENANCE AND METHODS OF OPERATIONS

8.3.1 Adequacy of Operating Procedures

Based on assessments from received documents and the site visit, operating procedures appear to be adequate.

8.3.2 Adequacy of Maintenance

Based on assessments from received documents and the site visit, Dewberry recommends improvements to the maintenance program. Recommended improvements include:

- Repair interior embankment sections eroded by wind driven waves
- Remove trees from both the interior and exterior slopes of embankments.
- Modify the current inspection program to include weekly observation of the embankments.

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9.0 ADEQUACY OF SURVEILLANCE AND MONITORING PROGRAM

9.1 SURVEILLANCE PROCEDURES

Normal plant surveillance procedures consist of daily monitoring of the water elevation in the Fly Ash Pond.

9.2 INSTRUMENTATION MONITORING

No instrumentation monitoring data was provided to Dewberry for review. Information provided during the site visit indicated that the embankments were not instrumented.

The boring logs provided indicate that three piezometers were installed as part of the 1980 boring program. Two of the piezometers were installed near the toe of the north embankment, and the third installed at the south end of the Lime Pond and Ash Pond divider dike. Elevations on the design drawings indicate the piezometers were installed to remain accessible after embankment construction (See Appendix A, Doc – 1). The piezometers were not visible in the vegetative cover during Dewberry's site visit.

9.3 ASSESSMENT OF SURVEILLANCE AND MONITORING PROGRAM

9.3.1 Adequacy of Inspection Program

Based on the data reviewed by Dewberry, including observations during the site visit, the inspection program is inadequate.

9.3.2 Adequacy of Instrumentation Monitoring Program

Based on the data reviewed by Dewberry, including observations during the site visit, the monitoring program is inadequate.

Dewberry recommends that the existing monitoring program be enhanced to include a weekly inspection of the embankments for signs of distress and to identify maintenance needs.

The small size of the impoundment does not warrant a sophisticated monitoring system. However, Dewberry recommends that the three existing piezometers be located and inspected to determine if they remain functional. If yes, the piezometers should be read monthly as part of an enhanced monitoring program.

APPENDIX A

Document 3

NPDES Permit No. TN 8503-0-02